ISSN 1346-7565 Acta Phytotax. Geobot. 68 (1): 39–44 (2017)
doi: 10.18942/apg.201616

Trigonostemon honbaensis (Euphorbiaceae), A New Species from Mt. Hon Ba, Southern Vietnam

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A new species, *Trigonostemon honbaensis* Tagane & Yahara (Euphorbiaceae), sp. nov., from Hon Ba Nature Reserve in Khanh Hoa Province, southern Vietnam, is described and illustrated. DNA barcoding data of the *rbcL* and *matK* regions is provided. *Trigonostemon honbaensis* is most similar to *T. longifolius* Baill. ex Müll.Arg., but distinguished by its less hairy leaves, truncate leaf base (attenuate to obtuse in *T. longifolius*), larger petals, shorter staminal column, and anthers lacking appendages.

Key words: Euphorbiaceae, Hon Ba Nature Reserve, new species, *Trigonostemon*, Vietnam

Trigonostemon Blume (Euphorbiaceae) comprises 85 species (Govaerts *et al.* 2000), mainly distributed in India, Sri Lanka, and SE Asia to Australia (Jablonski 1963, Airy Shaw 1976, Chantaranothai 2007, Li & Gilbert 2008). Seven species have been recorded in Cambodia (Gagnepain 1925, Dy Phon 2000, Toyama *et al.* 2013), 10 species in Laos (Gagnepain 1925, Newman *et al.* 2007), 14 in Thailand (Chantaranothai 2005, 2007) and 22 in Vietnam (Gagnepain 1925, Hô 2003, Thin 2007), indicating Vietnam to be the center of diversity for the genus.

Trigonostemon varies in the shape and size of the inflorescences and leaves, but is characterized by monoecy, simple indumentum, five sepals and petals, three or five stamens, filaments connate or only free at the tip, and a persistent calyx that is sometimes enlarged in fruiting (Blume 1826, Chantaranothai 2007, Thin 2007, Li & Gilbert 2008). It is similar to *Dimorphocalyx* Thwaites but distinguished by its fewer stamens (3 or 5 in 1 whorl vs. 10–15 in 2 or 3 whorls).

During our botanical surveys on Mt. Hon Ba, Khanh Hoa Province, southern Vietnam, in 2013–2015, we found a species of *Trigonostemon* with raceme-like panicles, leaves more than 30 cm long with a truncate base and short petiole. By comparing it with similar species using the taxonomic literature (Gagnepain 1925, Backer & Bakhuizen van den Brink 1963, Jablonski 1963, Whitmore 1972, Milne 1995, Hô 2003, Chantaranothai 2007, Thin 2007, Li & Gilbert 2008), dried specimens in herbarium BKF, BRUN, FOF, FU, HN, RUPP, SAR, SING and VNM, and digital images of specimens on JSTOR Global Plants [https://plants.jstor.org/ (accessed 1 Feb. 2016)] at K [http://apps.kew.org/herbcat/navigator.do (accessed 1 Feb. 2016)] and at P [https://science.mnhn.fr/institution/mnhn/collection/p/item/search (accessed 1 Feb. 2016)], we concluded that it differed from previously known taxa. We therefore describe it as new, *Trigonostemon honbaensis* (Fig. 2). Partial DNA sequences of the large subunit of ribulose-1,5-bisphosphate carboxylase oxygenase (*rbcL*) and maturase K (*matK*) were also determined (CBOL Plant Work-

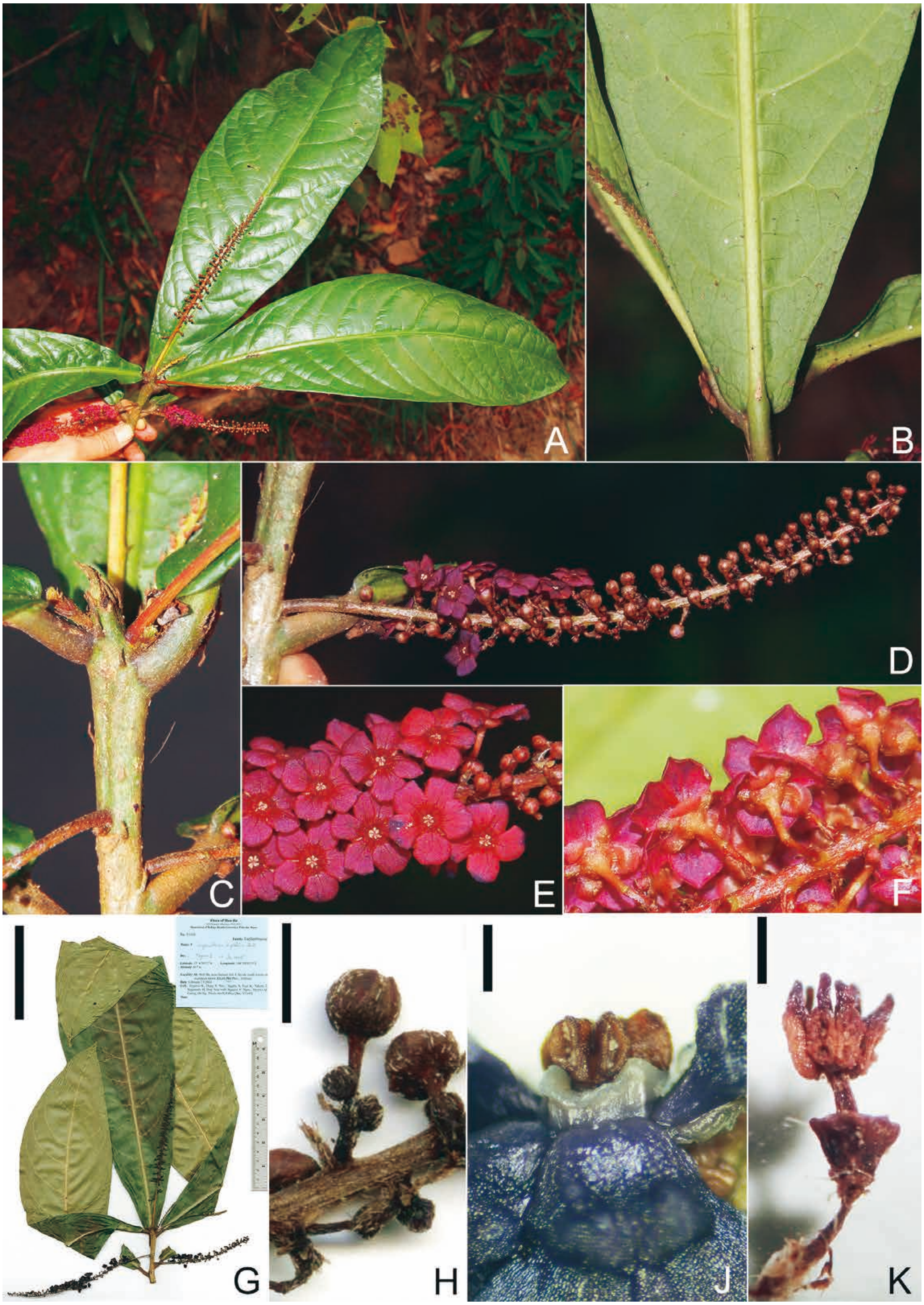

FIG. 1. *Trigonostemon honbaensis* Tagane & Yahara, sp. nov. (A–J), and. *T. longifolius* Baill. ex Müll. Arg. (K). A, flowering branch; B, portion of abaxial surface of leave; C, top branch; D, inflorescence; E & F, staminate flowers; G, holotype; H, flower buds; J, lateral view of anthers, disc and petals; K, Staminal column and anthers with large appendages. A–E: 23 February 2014. G–J: *Toyama et al. V1345* (FU). K: *Sangkhachand et al. 1019* (BKF). Scale bars G = 10 cm; H = 5 mm; J & K = 0.5 mm.

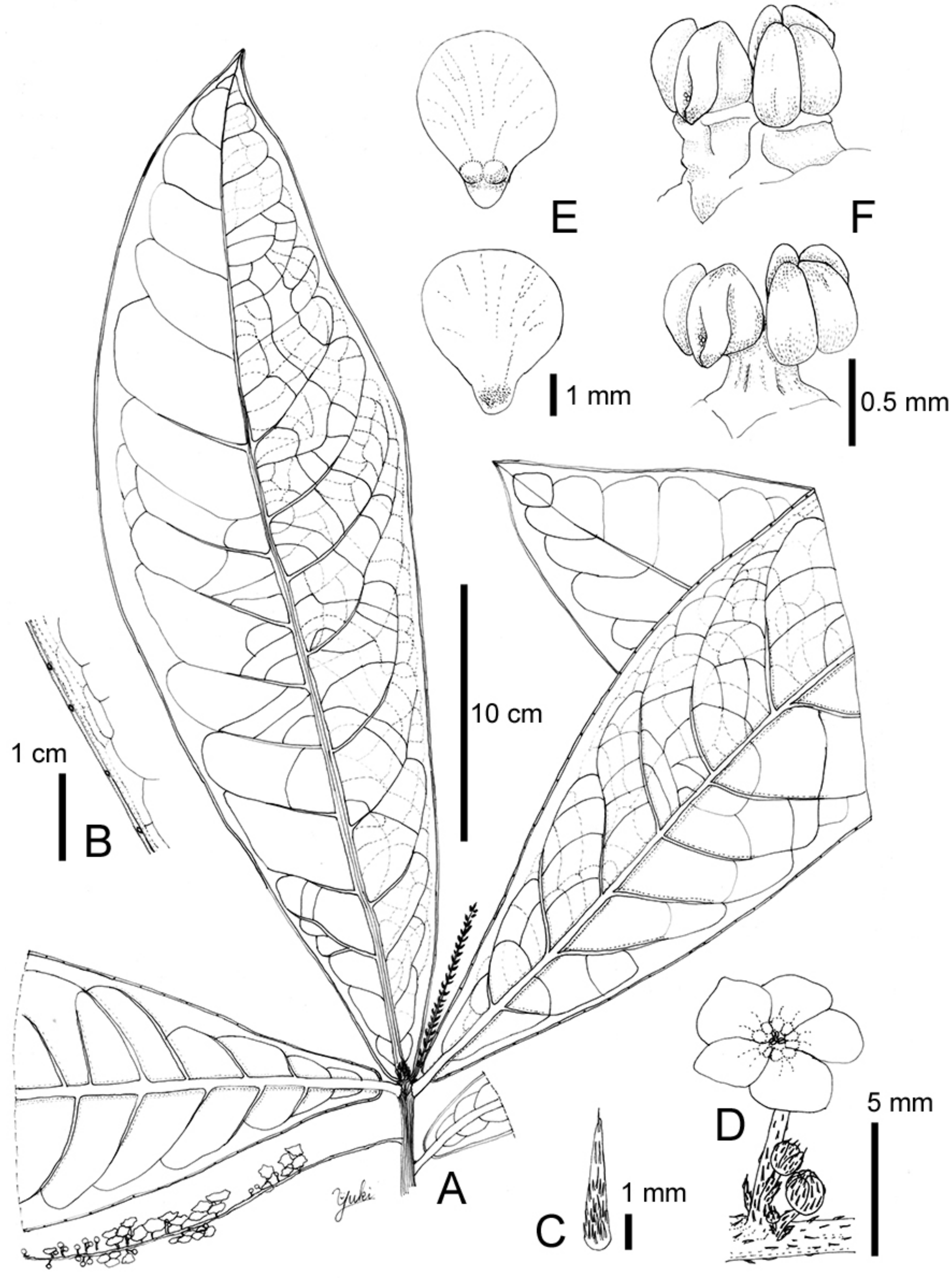

FIG. 2. *Trigonostemon honbaensis* Tagane & Yahara, sp. nov. A, Flowering branch; B, portion of leaf margin showing marginal glands; C, stipule; D, flower and flower buds; E, adaxial (above) and abaxial side (below) of petal; F, anthers and annular disc (above) and anthers and staminal column (below) in staminate flower. Materials from *Toyama et al. V1345* (KYO). Drawn by Y. Morita.

TABLE 1. Comparison of characters of leaves and staminal flowers between *Trigonostemon honbaensis*, sp. nov., and *T. longifolius*.

Characters	*T. honbaensis*, sp. nov.	*T. longifolius*
Leaf base	truncate	attenuate to obtuse[1), 2)]
Secondary veins	16–20 pairs	16–25 pairs[2)]
Petal size	ca. 4 × 3.5 mm	1.5–2 × 1.5 mm[2)]
Column length	0.4 mm	1–1.3 mm[2)]
Column diameter	0.3 mm	< 0.1 mm[1)]
Appendage with anthers	None	ca. 0.2 mm[1)]
Disc height	ca. 0.4 mm	ca. 0.25 mm[1)]

1) based on *Sangkhachand et al. 1019* (BKF).
2) from the description in Flora of Thailand (Chantaranothai 2007).

ing Group 2009). The extraction and sequencing followed published protocols (Kress *et al.* 2009, Dunning & Savolainen 2010) as in Toyama *et al.* (2015).

Taxonomic treatment

Trigonostemon honbaensis Tagane & Yahara, **sp. nov.**——Figs. 1 & 2.

Diagnosis. Similar to *Trigonostemon longifolius* Baill. ex Müll. Arg. of Myanmar, the Malay Peninsula and Sumatra in size and shape of the leaves and inflorescences, but distinguished by its truncate leaf base (vs. attenuate to obtuse), larger petals (4 × 3.5 mm in *T. honbaensis* vs. 1.5–2 × 1.5 mm in *T. longifolius*), short staminal column (ca. 0.4 mm long vs. 1–1.3 mm long) and appendages absent in staminate flowers (vs. conspicuously appendaged) (Table 1).

Typus. VIETNAM. Khanh Hoa Province, Mt. Hon Ba, 12°06'39.77"N, 108°58'59.23"E, alt. 617 m, 23 Feb. 2014, with stminate fl., *Toyama H.*, *Dang V. S.*, *Tagane S.*, *Fuse K.*, *Yahara T.*, *Nagamasu H.*, *Tran H.*, *Nguyen V. N.*, *Nguyen Q. C.*, *Do N. T.*, *Ho N. P. H. V1345* (holotype KYO!; isotypes FU!, VNM!, the herbarium of Hon Ba Nature Reserve!).

Description. Shrubs, 1.5 m tall; branchlets ribbed, lenticellate, yellowish brown when dry, sparsely appressed hairy when young, soon glabrous. Stipules linear-triangular, 3–4 mm long, appressed hairy abaxially, glabrous adaxially. Leaves alternate, usually clustered in pseudo-whorls, petiolate; petiole 0.9–1.5 cm long, hairy, glabrescent with age; blade narrowly obovate-elliptic, 30–41 × 9–13 cm, thick chartaceous, abaxially sparsely hairy, adaxially glabrous, base truncate, basal glands absent, margin entire, with scattered glands 0.4–2 cm apart, apex acuminate; venation penninerved, prominent abaxially, secondary veins 16–20 pairs, tertiary veins reticulate. Inflorescences axillary, raceme-like panicles, 10.3–17 cm long; peduncle and rachis appressed hairy; bracteoles linear-triangular, ca. 2.5 mm long, abaxially glabrous, adaxially appressed hairy. Staminate flowers ca. 5 mm in diam.; pedicel 2–4 mm long, appressed hairy; sepals 5, subequal, oblong-elliptic to orbicular, 1–2 × 1.2–2 mm, membranous, abaxially hairy in vicinity of mid-line, adaxially glabrous; petals 5, orbicular to broadly obovate, ca. 4 × 3.5 mm, membranous, adaxially with a pair of deep red swellings near base, otherwise wine-red, dark purple when dry, glabrous; disc annular, ca. 0.4 mm tall, ridged; stamens 3, anthers ca. 0.6 × 0.5 mm, appendages at apex absent, filaments united into a column, column ca. 0.4 mm long, ca. 0.4 mm in diam., pistillode absent. Pistillate flowers and fruits unknown.

Phenology. Flowering specimens collected in

February.

Distribution and habitat. Vietnam (known only from Mt. Hon Ba). *Trigonostemon honbaensis* is known only from a single individual found on a dry steep slope near a stream in a primary evergreen forest. The forest is dominated by *Archidendron chevalieri* (Kosterm.) I. C. Nielsen, *Barringtonia pauciflora* King, *Cinnamomum* cf. *curvifolium* (Lam.) Nees, *Dichapetalum tonkinense* Engl., *Gironniera subaequalis* Planch., *Gnetum macrostachyum* Hook. f., *Gynochthodes* sp., *Ixora* sp., and *Sarcosperma* cf. *kontumense* Gagnep. ex Aubrév.

Etymology. The specific epithet *honbaensis* refers to the type locality, Mt. Hon Ba.

GenBank accession no. Toyama et al. V1345: LC033610 (*rbcL*), LC033611 (*matK*). The BLAST similarity search based on the *matK* sequence of *T. honbaensis* showed homology as high as 586/591, 681/696, 770/789, 746/766 bp with sequences from *T. longifolius* (GenBank accession no. KJ709124), *T.* sp. (AB925089), *T. verrucosus* J. J. Sm. (FJ670020) and *T. thyrsoideus* Stapf (KR531600), respectively, in the DNA database.

IUCN conservation status. Data Deficient (DD) (IUCN 2012). Only one flowering individual was found in the primary evergreen forest where we collected the above specimens. The individual grows in a protected area of Hon Ba Nature Reserve, but the habitat is close to a road and can be easily affected by human disturbance from the road. Further intensive field surveys are needed to evaluate its conservation status.

Note. *Trigonostemon* is reported to be monoecious (Blume 1826, Baillon 1858, Müller 1866, Whitmore 1973, Chantaranothai 2007), but the individual we found had unisexual inflorescences consisting entirely of staminate flowers. *Trigonostemon honbaensis* appears to be dioecious, but the phenotypically and genetically similar species, *T. longifolius*, produces both unisexual (consisting entirely of staminate flowers) and bisexual inflorescences (with usually a few, less than 10 pistillate flowers per inflorescence) (Jablonski 1963, Chantaranothai 2007, and personal observation in Thailand [e.g. *Rueangruea et al. T5368* (BKF, FU, KYO, VNM)]. It is more plausible that the plant we found has only the former type of inflorescence. Additional materials are needed to confirm its sexuality and to make its description complete.

Trigonostemon honbaensis is distinguished from other species of *Trigonostemon* in Indochina by a combination of larger leaves more than 30 cm long, truncate leaf base, short petioles, axillary raceme-like panicles and absence of appendages in staminal flowers.

We would like to thank the Vietnam Administration of Forestry and Hon Ba Nature Reserve for permitting and supporting our field surveys in the protected area. We thank the directors and curators of the herbaria, BKF, BRUN, FOF, FU, HN, RUPP, SAR, SING, and VNM, for access to the specimens used in this study, Yuki Morita (Kyushu University) for the illustration of *Trigonostemon honbaensis* and Keiko Mase (Kyushu University) for determining the DNA sequences. This study was supported by the Environment Research and Technology Development Fund (S9 & S4-1601) of the Ministry of the Environment, Japan and by JSPS KAKENHI Grants (15H02640).

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Received February 15, 2016; accepted July 5, 2016